

WHAT IS CLAIMED IS:

1. An ink cartridge for an ink jet recording device having a recording head, the ink cartridge comprising;

a container including:

5 a lower section ink chamber;

an upper section ink chamber;

an ink supply port for supplying ink to the recording head;

an ink suction passage fluidly connecting the lower
10 section ink chamber to the upper section ink chamber, the lower section ink chamber being located upstream of the upper section ink chamber with respect to a direction of ink flow through the ink suction passage;

an ink flow passage fluidly connecting the upper section
15 ink chamber to the ink supply port; and

an air communication passage in fluid communication, with the lower section ink chamber and the ambient atmosphere; and,

a negative pressure generating mechanism disposed in the container, and disposed within the ink flow passage.

2. The ink cartridge according to claim 1, wherein the negative pressure generating mechanism includes a differential pressure valve having a membrane member.

3. The ink cartridge according to claim 1, wherein the
5 upper and lower section ink chambers are partitioned by a partition wall of the container, the partition wall extending in a substantially horizontal direction.

4. The ink cartridge according to claim 1, wherein the upper section ink chamber is divided into a plurality of
10 chamber regions by at least one wall having a communication port defined in its lower portion.

5. The ink cartridge according to claim 4, wherein a slope portion is formed proximate an outflow side of the communication port of the wall.

15 6. The ink cartridge according to claim 1, wherein a slope portion is formed in the ink chamber, the slope portion being oriented in a carriage moving direction of the recording device when the ink cartridge is mounted to the carriage.

7. The ink cartridge according to claim 1, further
20 comprising:

a filter member disposed in the flow passage at a position downstream of the upper section ink chamber and upstream of the negative pressure generating mechanism.

8. The ink cartridge according to claim 1, wherein an
5 inflow port of the ink suction passage has a cross-sectional area selected to facilitate retention of ink by capillary force.

9. The ink cartridge according to claim 1, wherein the ink suction passage is partially defined by a recess formed in
10 the container, and partially defined by a film member disposed adjacent the recess.

10. The ink cartridge according to claim 4, each of the plurality of chamber regions having a bottom portion having a beginning, and, moving downstream, the beginning of each
15 chamber region is higher than the beginning of a preceding said chamber region.

11. The ink cartridge according to claim 4, wherein the most downstream one of the chamber regions is in fluid communication with the negative pressure generating mechanism
20 via a flow channel that extends in a substantially vertical direction.

12. The ink cartridge according to claim 11, wherein the flow channel is partially defined by a groove formed in the container and partially defined by a film member disposed adjacent the groove.

5 13. The ink cartridge according to claim 1, further comprising a frame having first and second sides, the frame defining, in part an outer periphery portion of the upper section ink chamber and defining in part an air communication space, the air communication space being in fluid communication
10 with the lower section ink chamber at positions proximate the first and second sides of the frame.

14. The ink cartridge according to claim 13, wherein the frame has a wall that partitions the upper and lower ink chambers, the wall extending in a substantially horizontal
15 direction.

15. The ink cartridge according to claim 1, wherein a plurality of surface chambers are disposed proximate a surface of the container, the surface chambers being separated by a surface film member having air permeability and ink repellent
20 properties, and the lower section ink chamber being in fluid

communication with a first surface chamber of the plurality of surface chambers.

16. The ink cartridge according to claim 15, wherein a second surface chamber of the plurality of surface chambers is
5 in fluid communication with the ambient atmosphere via a surface passage defined in the surface of the container.

17. The ink cartridge according to claim 1, wherein the lower section ink chamber is in fluid communication with the ambient atmosphere via a flow passage that extends from a
10 position proximate an upper portion of the lower section ink chamber to a position above the upper section ink chamber.

18. The ink cartridge according to claim 17 wherein the container includes a container body having an opening and a bottom, and a cover member sealing the opening of the container
15 body.

19. The ink cartridge according to claim 18, wherein at least one of the ink chambers is defined, in part, by a film member disposed adjacent the opening of the container body.

20. The ink cartridge according to claim 18, wherein an
20 interior of the container body is partitioned by a frame, and

the upper section ink chamber is defined in part, by a film member disposed adjacent an opening of the frame.

21. The ink cartridge according to claim 20, wherein the frame partially defines a clearance portion located adjacent an
5 outer peripheral wall of the container body.

22. The ink cartridge according to claim 21, wherein the lower section ink chamber is in fluid communication with the ambient atmosphere via the clearance portion.

23. The ink cartridge according to claim 21, wherein a
10 recess is defined in a region proximate the clearance portion.

24. The ink cartridge according to claim 23, wherein the recess is defined in the surface of the container body.

25. The ink cartridge according to claim 20, wherein an interior of the frame is divided into a plurality of chamber
15 regions by at last one wall having a communication port, the chamber regions being arranged horizontally.

26. The ink cartridge according to claim 20, wherein the negative pressure generating mechanism is disposed proximate to a region where the upper section ink chamber is defined by the
20 frame.

27. The ink cartridge according to claim 1, wherein an ink injection opening is disposed proximate the ink suction passage.

28. An ink cartridge for an ink jet recording device
5 having a recording head, the ink cartridge comprising:
a container including;
an ink chamber;
an ink supply port for supplying ink to the recording head;
10 an ink flow passage connecting the ink supply port to the ink chamber; and
an air communication passage in fluid communication with the ink chamber and the ambient atmosphere;
a negative pressure generating mechanism disposed in the
15 container and disposed within the ink flow passage; and
an air communication valve connected to the air communication passage, the air communication valve being normally closed, the air communication valve being adapted to be opened when the ink cartridge is mounted to the recording
20 device.

29. The ink-cartridge according to claim 28, the air communication valve being in fluid communication with the ambient atmosphere via a capillary passage that is partially defined by a narrow groove formed in a surface of the container and partially defined by a film member disposed adjacent the narrow groove.

30. The ink cartridge according to claim 28, wherein an air chamber is disposed within the ink cartridge, the air chamber being separate from the ink chamber, and an urging mechanism, the urging mechanism urging the air communication valve to be normally closed; wherein the air communication valve blocks fluid communication between the air chamber and the ink chamber when the air communication valve is closed.

31. The ink cartridge according to claim 30, wherein the air chamber is connected to the ink chamber by a vent passage, and the air communication valve includes a valve member that is disposed in the vent passage, the valve member facilitating the sealing of a lower portion of the vent passage.

32. The ink cartridge according to claim 31, wherein the valve member includes a vertically extending slide member, and an elastic valve part disposed at a lower portion of the slide

member, and a spring attached to the slide member to urge the valve member upwardly.

33. The ink cartridge according to claim 31, wherein a window is defined in the container;

5 wherein the upper end of the valve member can be depressed from a position exterior to the ink cartridge through the window.

34. The ink cartridge according to claim 33, wherein the window is sealed by an elastically deformable, air impermeable
10 window film member.

35. The ink cartridge according to claim 30, wherein the air chamber is in fluid communication with the ambient atmosphere via a capillary passage defined in the surface of the container.

15 36. The ink cartridge according to claim 35, wherein the capillary passage is partially defined by a meandering groove defined in the surface of the container and an air impermeable film member disposed adjacent the meandering groove.

37. An ink cartridge for an ink jet recording device
20 having a recording head, the ink cartridge comprising:
a container including:

a lower section ink chamber;
an upper section ink chamber;
an ink supply port for supplying ink to the recording
head;

5 an ink suction passage fluidly connecting the lower
section ink chamber to the upper section ink chamber;

an ink flow passage fluidly connecting the ink supply port
to the upper section ink chamber; and

an air communication passage in fluid communication with
10 the lower section ink chamber and the ambient atmosphere;

a negative pressure generating mechanism disposed in the
container and disposed within the ink flow passage; and

a filter member, disposed at a filter placement portion
within the ink flow passage at a position upstream of the
15 negative pressure generating mechanism and downstream of the
upper section ink chambers.

38. The ink cartridge according to claim 37, wherein the
filter member is disposed in a region opposing the negative
pressure generating mechanism.

20 39. The ink cartridge according to claim 37, wherein a
circuitous portion of the ink flow passage has a circuitous

shape and is positioned in a substantially vertical plane, and is located proximate the filter member.

40. The ink cartridge according to claim 39, wherein the circuitous portion is partially enlarged to form an air bubble trap region.

41. The ink cartridge according to claim 37, wherein the filter member is installed in a through hole defined in the container, wherein the through hole is the filter placement portion.

10 42. The ink cartridge according to claim 37, wherein the filter member is disposed in a recess positioned adjacent the negative pressure generating mechanism.

43. An ink cartridge for an ink jet recording device, comprising:

15 a container having an ink supply port;

at least two ink chambers partitioned by a wall extending in a substantially horizontal direction in the container when the container is mounted on the ink jet recording device, a first ink chamber being located substantially in an upper section and a second ink chamber being located substantially in a lower section;

an ink suction passage fluidly connecting a bottom region of the lower section ink chamber to the upper section ink chamber; and

a differential pressure valve disposed within a flow passage fluidly connecting the ink supply port to the upper section ink chamber, and in a region proximate to the upper section ink chamber.

44. The ink cartridge according to claim 43, wherein a filter chamber and a differential pressure valve storage chamber are formed in the upper section ink chamber so that the filter chamber is located at an upstream side and the valve storage chamber is located at a downstream side, and wherein the filter chamber and the valve storage chamber are partitioned by a common wall.

45. The ink cartridge according to claim 43, wherein an upper region of the filter chamber is in fluid communication with the lower section ink chamber via a flow passage, and a portion of the flow passage has a circuitous shape and is defined in a substantially vertical plane.

46. The ink cartridge according to claim 43, wherein the upper section ink chamber includes two ink storage portions fluidly connected by a flow passage.

47. The ink cartridge according to claim 44, wherein each
5 of the ink chambers has an ink inflow port and an ink outflow port that are located proximate the bottoms of the ink chambers.

48. An ink cartridge that is detachably mounted on a carriage of an ink jet recording device, the carriage having an
10 ink jet head, comprising:

a container having an ink supply-port;

at least two ink chambers partitioned in the container, a first ink chamber being located substantially in an upper section of the container and a second ink chamber being located
15 substantially in a lower section of the container;

an ink suction passage fluidly connecting a bottom region of the lower section ink chamber to a bottom region of the upper section ink chamber; and

a negative pressure generating mechanism disposed within a
20 flow passage connecting the upper section ink chamber to the ink supply port.

49. The ink cartridge according to claim 48, wherein the upper section ink chamber is partitioned by at least one wall into a plurality of regions which are in fluid communication with each other via communication ports located proximate a bottom portion of each region.

50. The ink cartridge according to claim 48, wherein a filter member is disposed within a flow passage fluidly connecting the upper section ink chamber to the negative pressure generating mechanism.

51. The ink cartridge according to claim 48, wherein an inflow port of the ink suction passage has a cross sectional area selected to facilitate the retention of ink by a capillary force.

52. The ink cartridge according to claim 51, wherein the ink suction passage is defined in part by a recess formed in the container and defined in part by a film member disposed adjacent the recess.

53. The ink cartridge according to claim 49, wherein each of the plurality of regions in the upper section ink chamber having a bottom portion having a beginning, and, moving

downstream, the beginning of each region is higher than the beginning of a preceding said region.

54. The ink cartridge according to claim 49, wherein the most downstream one of the plurality of regions is closest to
5 the negative pressure generating mechanism, and is in fluid communication with the negative pressure generating mechanism via a flow passage that extends substantially vertically.

55. The ink cartridge according to claim 54, wherein the flow passage extending substantially vertically is defined in
10 part by a groove-like passage defined in an inner portion of the container and defined in part by a film member disposed adjacent the groove-like passage.

56. The ink cartridge according to claim 48, wherein the upper ink chamber has a first side and a second side, and an
15 air communication passage is disposed peripherally to the upper ink chamber, the air communication passage being in fluid communication with the lower section ink chamber at locations proximate the first and second sides.

57. The ink cartridge according to claim 56, wherein the
20 air communication passage is defined in part by a frame-like

wall, and wherein a portion of the frame-like wall divides the container into upper and lower sections.

58. The ink cartridge according to claim 48, wherein a recess is defined in the surface of the container body, the recess being partitioned into a plurality of surface chambers by a film member, the film member being formed of an air permeable and ink repellent material, the lower section ink chamber being in fluid communication with a first one of the plurality of surface chambers.

59. The ink cartridge according to claim 58, wherein a second of the plurality of surface chambers is in fluid communication with the ambient atmosphere through a passage defined in the surface of the container body.

60. The ink cartridge according to claim 48, wherein an ink injection port is located proximate the ink suction passage.

61. The ink cartridge according to claim 48, wherein the container includes a container main body having an opening and a bottom, and a cover member sealing the opening, the upper section ink chamber being defined in part by a wall disposed in the container main body and in part by a film member, and the

negative pressure generating mechanism is disposed in a mechanism recess defined in the surface of the container body.

62. The ink cartridge according to claim 48, wherein the lower section ink chamber is in fluid communication with the ambient atmosphere via a flow passage extending to an upper region of the container.

63. The ink cartridge according to claim 48, wherein the upper section ink chamber is partitioned by a wall, the wall having communication ports at a bottom portion and an upper portion of the wall.

64. The ink cartridge according to claim 61, wherein the mechanism recess has a through hole, an ink chamber side opposite the mechanism recess is sealed by a chamber sealing film member, and the mechanism recess is in fluid communication with the upper section ink chamber, via a filter member.

65. The ink cartridge according to claim 61, wherein a membrane valve and a membrane valve holding plate having a recess defining a flow passage for communication with the ink supply port are disposed in the mechanism recess, and the mechanism recess is sealed by a film member bonded to the surface of the container body.

66. The ink cartridge according to claim 48, further comprising:

an air communication valve in fluid communication with the lower section ink chamber and the ambient atmosphere, the air communication valve normally maintaining a valve closed state and being opened when the ink cartridge is mounted to the recording device.

67. The ink cartridge according to claim 66, wherein:

the air communication valve including a valve member elastically urged by a spring to normally maintain the valve closed state and to be opened by an external depression; and the air communication valve is sealed by a film elastically deformable by the external depression.

68. The ink cartridge according to claim 67, wherein the valve member has a sealing portion made of elastomer.